Pane 3 1820 shows the signals after they have propagated over a single mode optical fiber 40 km in length. At the end of the fiber, the signal reaches a receiver. The receiver is modeled as a PIN-diode receiver with a 7.5 GHz 4^{th} order Bessel filter. Pane 4 1830 shows the filtered signal.

A common way of measuring the quality of a transmitter is to measure a bit error rate curve (BER-curve) for the transmitter after transmission over a relevant length of fiber. Figure 19 illustrates the error associated with symmetric driver pulses and asymmetric driver pulses in accordance with one embodiment of the present invention. The BER curve for the symmetric driver of Figure 7B 1900 and the BER-curve for the asymmetric driver of Figure 18 1910 are plotted. The asymmetric driver gives a sensitivity gain of about 0.6 dB. Since penalties on the order of 1-2 dB are commonly accepted, a gain of 0.6 dB is a significant improvement.

Additional Illustrations

Figure 20 illustrates driver output, transmitter output, received signal and filtered signal for a symmetrical driver. Pane 1 2000 is a symmetrical driver output. Pane 2 2010 is the output from the transmitter given the input from pane 1. Pane 3 2020 is the signal received at the receiver after the signal of pane 2 propagates through 20 km of fiber. Pane 4 2030 is the filtered signal achieved by filtering the received signal of pane 3 with a 7.5 GHz fourth order Bessel filter. The resulting eye 2040 is significantly distorted.

Figure 21 illustrates driver output, transmitter output, received signal and filtered signal for a symmetrical driver in accordance with one embodiment of the present invention. Pane 1 2100 is an asymmetrical driver output. Pane 2 2110 is the output from the transmitter given the input from pane 1. Pane 3 2120 is the signal received at the receiver after the signal

of pane 2 propagates through 20 km of fiber. Pane 4 2130 is the filtered signal achieved by filtering the received signal of pane 3 with a 7.5 GHz fourth order Bessel filter. The resulting eye 2140 is substantially more symmetric than the resulting eye 2040 in Figure 20.

Figure 22 illustrates contour plots in accordance with one embodiment of the present invention. The plots illustrate the sensitivity after pulses with varying rise and fall times are propagated through 20 km of fiber. A more negative sensitivity value is better. The best sensitivity value that can be achieved for a driver with a symmetric waveform (i.e., the rise time is equal to the fall time) is a sensitivity value of approximately –17.1 dBm when the rise time and fall time are both 40 ps. The grid point where rise and fall time are both 40 ps is approximately half way between the contour 2200 representing sensitivity of –17.0 dBm and the contour 2210 representing sensitivity of –17.2 dBm.

In contrast, a driver with an asymmetric waveform with a rise time of 70 ps and a fall time of 10 ps has a sensitivity value of approximately –17.8 dBm. The contour 2220 representing a sensitivity of –17.8 dBm approximately passes through the grid point where rise time is 70 ps and fall time is 10 ps. The difference in sensitivity of 0.7 dBm is significant as a total acceptable loss due to dispersion in typical links are typically 2 dBm.

Thus, a method and apparatus for ringing and inter-symbol interference reduction in optical communications is described in conjunction with one or more specific embodiments. The invention is defined by the following claims and their full scope and equivalents.